work Safe! Bulletin

CARBON MONOXIDE POISONING

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A worker died from Carbon Monoxide (CO) poisoning while working on a gas powered forklift. The Workplace Safety and Health Division investigation concluded that the following factors contributed to the workers death:

- The worker ran a gas powered forklift engine for some time in a non-ventilated, enclosed room before shutting it off causing CO to accumulate.
- The worker continued to work in the area for an additional three to four hour period.
- The worker was working alone, with no working alone plan in place.

Several hours after he had been working repairing the forklift, the worker reported that he had a severe headache. Two hours later he was found unconscious and subsequently died of carbon monoxide poisoning. Although the forklift engine ran for only a few minutes earlier in the morning, because of the enclosed space, the high concentration of CO and the lack of ventilation, the Carbon Monoxide was trapped in the garage and breathed by the worker over the next few hours until death occurred.

Carbon Monoxide is a lethal poisonous gas produced by the incomplete combustion of any carbonaceous product including coal, wood, oil, gasoline, or propane powered engines, tools and heating appliances. It is colourless, odorless, tasteless and nonirritating and can overcome an exposed worker without warning. Recognizing early warning signs of CO exposure is difficult. The symptoms (headache, dizziness, and nausea) are often mistaken for other illnesses such as flu or food poisoning. If exposure continues, serious central nervous system impairment, coma and death can ensue.

The severity of symptoms is effected by a combination of:
- concentration of CO in the environment
- length of time of the exposure
- light, medium or heavy work loads and the resulting effect on breathing rate

An exposure of 80 to 100 ppm (parts per million) for 1 to 2 hours with moderate exertion can result in decreased exercise tolerance and may bring on chest pains and cause an irregular heartbeat. Symptoms associated with exposure of 100 to 200 ppm include headache, nausea and mental impairment. The mental impairment may effect the workers ability to escape the hazardous environment.

More serious symptoms such as central nervous system effects of staggering, confusion, changes in personality; as well as muscle aches, coma and death, are associated with CO exposure concentrations of 700ppm or greater for an hour or more. It should be noted that lower levels of exposure for lengthy periods of time if undetected, could lead to coma and death.

Victims of CO poisoning should be immediately removed from the exposure site and given 100% oxygen. Hyperbaric chambers provide oxygen under pressure and are sometimes necessary in cases of serious CO poisoning. It is always wise to ensure that the victims of any degree of exposure receive prompt professional medical assistance. Recovered workers may have long term Central Nervous System (CNS) impairment.

Workplace exposures to CO can come from equipment such as:

- Gasoline powered pressure washers
- Ice maintenance machines
- Cars, trucks, recreational and other vehicles
- Forklifts, both gasoline and propane fueled
- Gasoline powered compressors and pumps
- Gasoline powered small engines, lawn mowers, snow blowers, boat motors, motor cycles, snowmobiles, etc.
- Fuel fired heating systems including overhead direct-fired units
- Gas appliances and fireplaces
- Welding equipment
- Temporary heating of hoarded construction areas

Two surveys assessing individual beliefs, knowledge and risk perceptions regarding CO suggest that many workers are unaware of the hazards and warning signs associated with CO exposure. Many of the respondents (26% of the 416 surveyed) incorrectly believed that with a window open, the use of a gasoline powered engine indoors would be safe. The majority of the respondents (54%) incorrectly believed that it was safe if the windows and doors were open and an exhaust fan was running.

Where carbon monoxide is generated in the workplace employers must implement control measures sufficient to maintain exposure levels below the Occupational Exposure Limit (OEL) of 25 parts per million, these may include:

- Location of gasoline/propane powered equipment or tools outside and away from fresh air intakes.
- When engines are operated indoors – example motor repair facilities there must be properly designed and approved local mechanical exhaust ventilation connected to flexible ducts and discharged outside, minimum capture velocity requirements must be met.
- Continuous monitoring of CO levels in the workplace with audible alarms to indicate levels in excess of the TLV.
- Ensuring that equipment such as forklifts are maintained within recommended emission limits.
- Ensuring adequate ventilation is provided for mobile equipment used indoors.
- Educating workers regarding the sources and conditions that may result in CO poisoning.
- Learning to recognize the warning symptoms of CO poisoning.

Wherever possible the employer should consider the use of engines and tools powered by electricity or compressed air instead of gasoline powered equipment for indoor applications.